

Tutorial 4 - Problem 2

Consider the Bubble Sort algorithm below:

```
for end in range(len(data) - 1, 0, -1):
    for swapIndex in range(0, end, 1):
        if data[swapIndex] < data[swapIndex + 1]
            # we swap:
            tempVar = data[swapIndex + 1]
            data[swapIndex + 1] = data[swapIndex]
            data[swapIndex] = tempVar
```

Hand trace the algorithm while we are sorting the following data list in a **decreasing** sort order:

index: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9
data: 4 9 6 3 1 8 2 0 5 7

As we are answering this question, let's show our work.

`range(len(data) - 1, 0, -1) -> 9, 8, 7, 6, 5, 4, 3, 2, 1`

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
9	0,1,2,3,4,5,6,7,8	0	9	9, 4, 6, 3, 1, 8, 2, 0, 5, 7
		1	6	9, 6, 4, 3, 1, 8, 2, 0, 5, 7
		2		9, 6, 4, 3, 1, 8, 2, 0, 5, 7
		3		9, 6, 4, 3, 1, 8, 2, 0, 5, 7
		4	8	9, 6, 4, 3, 8, 1, 2, 0, 5, 7
		5	2	9, 6, 4, 3, 8, 2, 1, 0, 5, 7
		6		9, 6, 4, 3, 8, 2, 1, 0, 5, 7
		7	5	9, 6, 4, 3, 8, 2, 1, 5, 0, 7
		8	7	9, 6, 4, 3, 8, 2, 1, 5, 7, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
8	0,1,2,3,4,5,6,7	0		9, 6, 4, 3, 8, 2, 1, 5, 7, 0
		1		9, 6, 4, 3, 8, 2, 1, 5, 7, 0
		2		9, 6, 4, 3, 8, 2, 1, 5, 7, 0
		3	8	9, 6, 4, 8, 3, 2, 1, 5, 7, 0
		4		9, 6, 4, 8, 3, 2, 1, 5, 7, 0
		5		9, 6, 4, 8, 3, 2, 1, 5, 7, 0
		6	5	9, 6, 4, 8, 3, 2, 5, 1, 7, 0
		7	7	9, 6, 4, 8, 3, 2, 5, 7, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
7	0,1,2,3,4,5,6	0		9, 6, 4, 8, 3, 2, 5, 7, 1, 0
		1		9, 6, 4, 8, 3, 2, 5, 7, 1, 0
		2	8	9, 6, 8, 4, 3, 2, 5, 7, 1, 0
		3		9, 6, 8, 4, 3, 2, 5, 7, 1, 0
		4		9, 6, 8, 4, 3, 2, 5, 7, 1, 0
		5	5	9, 6, 8, 4, 3, 5, 2, 7, 1, 0
		6	7	9, 6, 8, 4, 3, 5, 7, 2, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
6	0,1,2,3,4,5	0		9, 6, 8, 4, 3, 5, 7, 2, 1, 0
		1	8	9, 8, 6, 4, 3, 5, 7, 2, 1, 0
		2		9, 8, 6, 4, 3, 5, 7, 2, 1, 0
		3		9, 8, 6, 4, 3, 5, 7, 2, 1, 0
		4	5	9, 8, 6, 4, 5, 3, 7, 2, 1, 0
		5	7	9, 8, 6, 4, 5, 7, 3, 2, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
5	0,1,2,3,4	0		9, 8, 6, 4, 5, 7, 3, 2, 1, 0
		1		9, 8, 6, 4, 5, 7, 3, 2, 1, 0

		2		9, 8, 6, 4, 5, 7, 3, 2, 1, 0
		3	5	9, 8, 6, 5, 4, 7, 3, 2, 1, 0
		4	7	9, 8, 6, 5, 7, 4, 3, 2, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
4	0,1,2,3	0		9, 8, 6, 5, 7, 4, 3, 2, 1, 0
		1		9, 8, 6, 5, 7, 4, 3, 2, 1, 0
		2		9, 8, 6, 5, 7, 4, 3, 2, 1, 0
		3	7	9, 8, 6, 7, 5, 4, 3, 2, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
3	0,1,2	0		9, 8, 6, 7, 5, 4, 3, 2, 1, 0
		1		9, 8, 6, 7, 5, 4, 3, 2, 1, 0
		2	7	9, 8, 7, 6, 5, 4, 3, 2, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
2	0,1	0		9, 8, 7, 6, 5, 4, 3, 2, 1, 0
		1		9, 8, 7, 6, 5, 4, 3, 2, 1, 0

end	range(0,end,1)	swapIndex	tempVar	data (at end of iteration)
1	0	0		9, 8, 7, 6, 5, 4, 3, 2, 1, 0

